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UTERINE ROTATION:

ITS CLINICAL IMPORTANCE IN PREGNANCY AND LABOUR.

BY

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UTERINE ROTATION.

It is nearly four years ago since I had the honour of reading a paper to this Society on a Variety of Post-Partum Shock, some cases of which had come under my notice.

I ascribed the occurrence of the shock to bruising of the ovaries during the application of the Credé method in the third stage of labour, and stated my belief that owing to the frequent occurrence of uterine rotation in pregnancy, the ovaries are so situated as to be not uncommonly in danger of injurious compression during the expression of the placenta, and that this compression might produce alarming reflex manifestations.

With increasing experience I have grown even more confident of the very frequent occurrence of this uterine rotation, in the third stage of labour especially. Its amount varies in degree in different patients, but in the vast proportion of cases its existence is distinctly to be observed, and its amount easily appreciated. For a record of my previous cases *vide Edinburgh Medical Journal*, July 1889. See also similar cases recorded by Graham, *British Medical Journal*, May 1891, and by Newell, Leonard's *Illustrated Medical Journal*, Detroit, July 1890.

I propose to-night to adduce some additional facts in support of my contention, as in my former paper I did little more than relate the cases and briefly state the conclusions at which I had arrived.

During the last three years I have received many voluntary and unsolicited corroborations of the truth of what I then stated, from medical practitioners whose clinical experience tallied with my own.

Recently Dr Webster, from a study of post-mortem and frozen sections, has stated that frozen sections do not support the statement that the uterus is rotated, and he further states that the method of frozen sections is a sure method, implying that its results must be absolutely correct. Now, against this assertion I feel bound to enter a protest. I agree with Fritsch when he says that "The position of the female genital organs in a living woman can only be determined by the examination of a living woman, and that post-mortem sections, whether frozen or not, are never capable *by themselves* of giving a decision as to their position in the living

subject." On the other hand, I quite admit that examination of the living subject is, of course, always liable to error, and one can never claim for it absolute accuracy, owing to the impossibility of getting directly at the uterus, and the varying degrees of skill of different examiners.

Of this, however, I am sure, that rotation of the uterus, especially in the third stage of labour and immediately post-partum, can be better observed clinically than after death; and owing to the special facilities existing then, one can claim for one's clinical examination a very fair degree of accuracy, perhaps greater than under any other circumstances.

Rotation is to a great extent a vital property of the uterus; it tends to disappear when muscular contraction ceases, and to become undone by post-mortem gravitation. The greater the muscular contraction and retraction, the more marked (*cæteris paribus*) is the rotation. Such vital processes are apt to be overlooked in the conclusions which are drawn from the examination of frozen sections alone, and consequently the results of patient anatomical work often lose much of their practical importance. Take as an illustration the position of the apex-beat of the heart. If one were guided by post-mortem evidence alone, one would be led considerably astray. One would imagine it to be produced, as Vierordt shows, by the tip of the right ventricle, and to be further from the middle line than it is; whereas, as a result of a movement of rotation occurring during each systole, the apex of the left ventricle comes to the front and impinges on the chest-wall at a spot nearer the middle line.

The minute and careful descriptions of post-mortem frozen sections are interesting enough in their way, and have no doubt done a great deal to open up and elucidate much that is of importance as regards the relationships of parts which are more or less rigid or incarcerated, and whose position is not much affected by death, and post-mortem changes, especially and notably,—for example, advanced pregnancy, the two first stages of labour, and certain cases of extra-uterine gestation.

They are, however, of no practical value whatever in alone determining the exact position of a freely movable organ, such as the body and fundus of the uterus, which even in life is affected by every movement of the body, and whose attitude, especially after labour, is to a great extent dependent on muscular vitality and tonicity. Especially does this hold good in the determination of the position of the unimpregnated uterus, the uterus in early pregnancy, and the uterus in the third stage of labour and post-partum. For in these circumstances the uterus is freely movable, not being unduly large, and consequently comparatively little influenced by outside pressure apart from the general abdominal pressure.

Webster found that in all his cases the walls of the uterus were

bloodless, showing that strong muscular contraction had at one time existed. In frozen sections the post-partum uterus resembles a molluscos plastic mass, totally different to the impression it gives one clinically in the early puerperium of a firm, hard coherent body, with a definite shape and outline which can be easily recognised. The difference is simply that between life and death. The post-mortem uterus has lost none of its material constituents, but it has lost that subtle and mysterious thing called life, that which gave it form and vigour, and without which it is but a piece of inert matter dependent for its form and position on accidental circumstances. It is probable, however, that owing to the muscular degeneration and progressive absorption which takes place during involution, that uterine rotation becomes less distinct as the puerperium advances and muscular contraction ceases.

For these reasons I do not think we are justified in assuming that the position or relations of the puerperal uterus can be at all satisfactorily determined by post-mortem examination alone. The conclusions of such methods are certainly misleading, and are productive of no practical results.

I. POSITION OF THE UTERUS.

(a.) *Unimpregnated*.—It is now clearly established that the uterus, in addition to its inclination forwards, and its usual deviation to the right side, is rotated on its longitudinal axis in the vast majority of cases in such a way as to bring its left border forwards. This rotation, which occurs in the unimpregnated condition, and which has been described by Rouget, Claudius, Krause, His, Lusk, Spiegelberg, Martin, and others, becomes much more marked in the pregnant condition. According to Dohrn, Spiegelberg, and Olshausen, this rotation is caused mainly by the pressure of the rectum, during development, pressing on the left side. Pfannkuch quotes Thiersch, who says that Müller's ducts often lie obliquely or perpendicularly to one another in embryonic sheep, and Dohrn says that in sheep, cattle, and human embryos the left duct usually lies further forward than the right. Pfannkuch says, "The inclination of the fundus to the right with rotation of the left edge forwards is a position which has already shown itself in foetal life, and as regards essentials is to be traced back to the first development of the foetal intestines." Spiegelberg thinks the weight of the uterus in the right lateral posture (which is the commoner) is another potent cause.

(b.) *During pregnancy* the rotation to the right on the longitudinal axis becomes still more evident, and, according to Chaignot, Charpentier, and others, is more marked during the last month. Schroeder, Stratz, Freund, Olshausen, and E. Martin have established this beyond the possibility of a doubt, and Charpentier, Spiegelberg, Kölliker, Lusk, Rouget, Bayer, Küstner, Winter, Tarnier,

Claudius, Croom, Krause, and others all describe this marked rotation. Depaul remarks that in a pregnant uterus "Rotation is a fact which has been confirmed by numerous necropsies." Croom has noted in many cases that in pregnancy the anterior surface of the uterus looks to the right, so that the transverse axis of the fundus is in the right oblique diameter of the pelvis. Schroeder and Stratz, in a frozen section made on the body of a woman in labour at the beginning of the first stage, describe the uterus as deviating so much from the symmetrical position that its left border was turned forwards and downwards, its right border backwards and upwards. Winter also describes a frozen section which he made, in which the pregnant uterus lay exactly in the middle line with its left edge forwards. In another section which he made the bowels were enormously distended with gas, and he did not look for rotation. Few observers seem to have done so.

In certain animals—the cow, for instance—this uterine rotation is greatly exaggerated. Sometimes it takes place to such an extent as to twist the vagina secondarily upon itself, and so create a serious source of dystocia (Auvard, Charpentier). Dolèris, quoted by Charpentier, has observed a case where rotation was so great in a pregnant woman that there were "*phénomènes d'obstruction graves*" during the labour. This was due to a semi-pathological condition associated with abnormal relaxation of the pelvic tissues. The rotation in this case, strangely enough, was to the left.

A great many causes have been adduced to account for this rotation.

Spiegelberg thinks it depends mainly on an inherited tendency, but that it is increased by the small depth the abdominal cavity offers in the middle line, owing to the prominent spinal column, as well as by the force of gravity in consequence of most pregnant women lying on their right side.

E. Martin says that often in Cæsarean section, where lordosis was present, the uterus was so excessively rotated that its left border lay in the middle line anteriorly.

Schroeder and Stratz believe, from clinical observation as well as frozen sections, that this rotation of the uterus in pregnancy is due to the position of the child in utero. That side of the uterus which corresponds to the back of the child is always rotated forwards. They describe the breech as coming sideways out of the body of the uterus, the corresponding border of the uterus as turned forwards, and the corresponding ligamentum rotundum as being more tightly drawn, while the fundus sinks over to the opposite side. This they regard as the normal process. They further say, "If we regard the usual first position of the head, which is so frequent, we observe that while the ring of contraction moves upwards upon the child, the fundus inclines somewhat to the right—*i.e.*, to the side of the abdomen of the child.

This is easy to recognise by the stronger tension of the left round ligament, because it is inserted higher than the right one. The left round ligament is clearly to be felt somewhat to the left of the median line, while the right is only to be felt sideways with difficulty."

In observations of 120 head positions, they found that in 102 the ligamentum rotundum, which corresponded to the back of the child, was rotated forwards. In other 15 cases it turned forwards after the emptying of the bladder, and only in three cases was the tension of the round ligaments the same on both sides, and in these three cases the breech went straight out forwards, while the fundus sank backwards. In no single case could they observe that the round ligament corresponding to the abdomen of the child lay forwards.

I cannot agree with Schroeder and Stratz in ascribing the rotation of the uterus to the position of the foetus in utero. I am inclined to agree with Spiegelberg's views so far, but I think there are other causes which deserve to be brought forward.

The first is the traction exercised by the round ligaments. An important point to be remembered (which has been pointed out by Joulin, Depaul, Tarnier, and Chantreuil) is that the insertions of the round ligaments and of the tubes are found on the fully pregnant uterus nearly at the union of the anterior third with the posterior thirds of the organ. Stoltz has found that the round ligaments are quadrupled in size during pregnancy, and he finds that the right round ligament is shorter and thicker than the left. Schroeder and Stratz have proved that the left round ligament is inserted higher on the uterus than the right, and is therefore more tensely stretched. Homburger finds the left ligamentum rotundum usually more distinct and larger than the right, and that the right one is only to be felt rarely when the uterus is rotated to the left. The more tensely stretched left round ligament will thus tend to increase rotation by pulling the left border of the uterus forwards.

Another cause is one which I believe acts chiefly in the early months of pregnancy, and that is the asymmetry of the bladder when it is distended. The full bladder bulges to the right side; it will thus push back the right border of the uterus, and the loaded rectum will push forward the left border. These latter influences, as I have said, can only act on the pregnant uterus while it is yet a pelvic organ, but at any rate they will help to give it a "set" in the direction I have indicated. When Resident Physician in the Royal Maternity Hospital here, I conducted a series of twenty observations on distended bladders in pregnancy, and found that in every case a flexible bougie introduced into the bladder passed distinctly to the right side, thus proving that the greatest distention of the bladder was in that direction.

Yet another cause of the rotation of the pregnant uterus is one

which I consider to be a most potent one, and it is to be looked for in the disposition and arrangement of the middle layer of the muscular fibres of the uterus. I would call this an intrinsic cause of rotation as opposed to the extrinsic causes just considered. These muscular fibres run obliquely in all directions, and it is impossible to conceive that their influence can be equal on both sides. The uterus in this respect may be compared to the heart. The heart is fixed at its base at its junction with the aorta, and at every ventricular systole it rotates on its longitudinal axis to the right, so that the left ventricle comes more forward. The uterus is likewise fixed partly by the ligaments in the pelvic cavity, and partly by its insertion into the vagina. The fundus would correspond to the apex of the heart. As the muscular fibres develop in pregnancy, they in all probability tend to increase the rotation to the right, by being brought into play *actively* in the intermittent uterine contractions which are known to exist all through pregnancy; and *passively*, owing to the stretching which the uterine walls then undergo through the development of the foetus. To illustrate the effects of distention: take a fresh bladder, fix it below, and distend it moderately with water; we shall find that the bladder rotates on its longitudinal axis, and the greater the distention up to a certain point the more marked will be the rotation. The same thing occurs in the uterus when its walls become distended by the rapid growth of its contents during pregnancy, the oblique muscular fibres being stretched and passively helping to increase the rotation of the organ. I have only assumed so far that the arrangement of the muscular fibres in the uterus is such as to bring this about; but Auvard confirms the truth of my assumption, as he has shown that the development of the uterus is rarely perfectly symmetrical. He has shown, in following the development of the pregnant uterus, that the symmetrical development of the two halves of the organ produced a uterus which seemed median, while the asymmetrical development seemed to give a right or left inclination, as the case may be. The right development is by far the most common, and any real deviation is simply secondary to that due to greater development.

The anterior surface of the uterus is usually inclined towards the side on which the organ is most developed. In this way the more voluminous horn seems to draw after it the corresponding side of the gestating organ back towards the vertebral column, withdrawing the broad ligament from the same side of the abdominal wall, and acting conversely on the other broad ligament. This explains clearly why rotation becomes more marked during labour and in the early puerperium, the muscular fibres being then in a state of great activity.

The unequal development of different parts of the uterus in pregnancy is further confirmed by Joulin, who says that the

increase during the first months is chiefly in the direction of the transverse and antero-posterior diameters, and by Tarnier and Chantreuil, who state that the fundus of the organ increases considerably during the first six months, and the lateral parts follow this increase unequally. The inferior part develops chiefly during the three last months, and is usually more dilated anteriorly than posteriorly, the posterior part of the body being that which develops most in the upper two-thirds.

Frequency of Right Lateral Rotation of the Uterus, and its Relation to the Position of the Child.

Instead of ascribing the rotation of the uterus to the position of the child, as do Schroeder and Stratz, I believe with Lusk, Spiegelberg, and E. Martin, that the position of the child is probably influenced by the rotation of the uterus. Bayer is of opinion that owing to the traction exercised by, and the kind of hypertrophy of, the muscular fibres, the shape and appearance of the uterus are much influenced in the later months of pregnancy by the growth of the foetus. This can only be so, however, in the later months.

I am far from doubting the accuracy of Schroeder's and Stratz's observations, for I am convinced that they correctly represent the usual state of matters. In their theory as to the production of the rotation, however, they confound cause with effect; for it is not the position of the foetus in utero which causes the rotation, but it is the rotation which to a great extent influences the position. It is possible that the foetus during the last month of pregnancy may help by its position to increase the already existing rotation, and so make it more marked. We are able, therefore, to ascertain approximately the frequency of the occurrence of right lateral rotation of the uterus by considering the position of the child, which is so much influenced by the rotation. We argue from the effect caused to the cause itself. If we allow that the position of the child is caused by the rotation, then the demonstration of the frequency of the occurrence of the position will give the frequency of occurrence of the rotation. When the uterus is rotated on its longitudinal axis to the right, the transverse axis of the uterus lies diagonally in the pelvis in the right oblique diameter. This to a great extent accounts for the fact that in cranial presentations (which constitute fully 95 per cent. of all labours) the vertex of the foetal head lies, in 99 per cent., in the right oblique diameter of the pelvis. According to Spiegelberg, the back of the child in vertex presentations is directed to the left and forwards in 70 per cent. of cases, and to the right in 30 per cent. When it is directed to the right it is most usually inclined backwards. Although Schroeder and Stratz argue erroneously from their premisses, and confound cause with effect, yet their statistics are sufficiently

reliable to be accepted with confidence. They found that out of 120 head presentations which they examined, the uterus was rotated in 117,—in other words, in 97·6 per cent. They do not definitely state whether rotation was right or left, but say that the border of the uterus corresponding to the foetal back was always turned forwards. Counting only (by general statistics) those cases where the back was forward and to the left, this would give 84 left occipito-anterior positions out of those 120 cases as the very lowest computation,—in other words, Spiegelberg's 70 per cent. But from my own observations I am distinctly of opinion that right lateral rotation of the uterus also occurs in right occipito-posterior positions, though perhaps not quite so constantly as in left occipito-anterior cases. Such being the case, the percentage of cases of right lateral rotation in vertex presentations alone would in all probability be nearer 90 than 70.

Chaignot has carefully investigated thirty cases, with the following results:—

21 were O.L.A. with right rotation	= 70	per cent.
1 was O.L.A. with no rotation	= 3·4	„
3 were O.D.P. with right rotation	= 10	„
3 were O.D.P. with left rotation	= 10	„
2 were O.D.P. with no rotation	= 6·6	„

That is to say, in 80 per cent. there was distinct right rotation, in 10 per cent. there was left rotation, and in 10 per cent. there was no appreciable rotation at all.

There were 22 primary O.L.A. cases = 73·4 per cent.

There were 8 primary O.D.P. cases = 26·6 „

The vertex lay in the right oblique diameter of the pelvis in every case to begin with; one changed to O.L.P. at the beginning of labour. Chaignot's cases will be more fully considered afterwards.

We are, I think, therefore justified in concluding from the foregoing statements that in vertex cases the uterus is rotated to the right on its longitudinal axis in at least 80 per cent. of cases, probably more. Breech and face cases also present most commonly in the right oblique diameter of the pelvis, and from this circumstance we may in like manner reasonably conclude that the transverse axis of the uterus in the majority of these presentations also occupies the right oblique diameter of the pelvis.

I have on two occasions been able to verify these statements at post-mortem examinations. In both cases the long axis of the vertex was lying in the right oblique diameter of the pelvis, and the foetal back lay forwards and to the left. Both uteri were distinctly rotated to the right, and their left borders came forward.

Charpentier says that rotation of the uterus to the right always occurs in pregnancy, and agrees with Spiegelberg in stating that the position of the foetal head, face, and breech depends upon the conformity of the uterus to the pelvis. Tarnier and Chantreuil also coincide in this opinion.

(c.) *Position of the Uterus in the Third Stage of Labour and Immediately Post-partum.*—It is to be particularly noted that in examining post-partum uteri in an ordinary post-mortem examination they will be found to have fallen backwards in many cases, owing to the relaxation of the muscles and the emptying of the vessels, in conjunction with the dorsal decubitus of the body; and, as I have already said, frozen sections are liable to fallacy.

Owing to the large size of the uterus and the extreme laxness of the abdominal walls in the early days of the puerperium, its position can usually be satisfactorily ascertained clinically after careful examination.

Schroeder and Stratz, in a frozen section which they made through the body of a woman who had just been delivered, found that the uterus was fully a handbreadth above the umbilicus, and had sunk with the fundus towards the right. They describe the uterus as being twisted with its left border forwards.

A priori, we should expect that the post-partum uterus would continue to maintain the same rotation on its longitudinal axis which it had during pregnancy, and this, as a matter of fact, is the case. Rotation is, I think, more marked in the third stage than even immediately post-partum, owing to the strong muscular contraction and retraction; and it is more easily observed, as its shape is not so much modified by its contents as when the foetus is in utero. Schroeder and Stratz have found that both in the third stage and in the puerperium rotation can be clearly observed.

The puerperal uterus, after complete delivery, usually gives an approximate and diminished representation of the uterus before delivery, and the puerperal uterus is but an accentuated reproduction of its primitive form.

The fundus of the post-partum uterus seldom lies mesially. It usually inclines to the right side,—(1), because it has a natural lie in that direction; (2), owing to some extent to the influence of the rectum; and (3), from the accident of position. If the bladder be distended, the fundus is thrown to the left. Schroeder and Stratz believe that the fundus uteri generally falls over to the side to which it has drawn itself back over the child's breech,—*i.e.*, "in the first position to the right, in the second position to the left. Also the border corresponding to the child's back is rotated forwards: in the first position it would be the left border, in the second position the right border."

In 150 cases which they observed in the third stage, and immediately post-partum, the uterus only occupied the middle line four times, without rotation on its long axis. One of these cases was

after the birth of twins with two large, equally developed children. In the other three the breech went straight out of the uterus forwards. In all the other cases the fundus uteri, after the birth of the child, lay to the right, with that border to the front which had corresponded to the back of the child. Spiegelberg says that immediately after labour the uterus is usually in the median line, but now and then inclines to the right, more rarely to the left side, and, as a rule, is twisted to the right round its axis. When the bladder is full it forces the uterus away from the abdominal wall and straightens it. At the same time it pushes it to one side, and thereby increases its rotation round its longitudinal axis. Spiegelberg inclines to think that the distended bladder usually pushes the uterus to the right, but Croom has shown that it generally pushes it to the left.

Croom has found, from clinical observation, that in many cases the puerperal uterus is rotated round its central axis, so that in fact the transverse axis of the uterus no longer corresponds to the transverse diameter of the pelvis. One side of the uterus is thrown forwards, with the result that its transverse axis corresponds to the oblique diameter of the pelvis. Out of forty cases which he noted, ten showed distinct rotation to the right. His observations were made on uteri which had already begun to involute, and where in all probability the altered state of contraction of the round ligaments, and the commencing degeneration of the muscular fibres of the uterus, had modified their original position.

Börner and Pfannkuch have both investigated the rotation of the puerperal uterus. Börner, out of 64 post-partum cases which he observed, relates that in 50 rotation was entirely absent, in 12 the rotation was to the right, and in 2 to the left. His observations, however, as he himself admits, must not be taken as contradicting the usually accepted ideas. He thinks that after involution has set in the uterus is too soft and flabby to be acted upon by the forces which formerly influenced it, and any special position it may take up during that time is purely accidental.

Pfannkuch has observed that when the bladder is full, right rotation of the uterus is increased; and Croom has noted that in cases where the rotation was absent or only slight when the bladder was empty, it was well marked when the bladder was distended.

The bladder usually bulges more to the right side in consequence of its asymmetry, and when it becomes distended it encroaches more on the right side, and thus helps to increase the rotation of the uterus. The post-partum uterus is, on account of its size, very easily influenced by bladder distention. The distention of the bladder by no means causes the rotation of the uterus; it simply increases the already existing rotation.

It is often a difficult thing in the third stage of labour, and immediately post-partum, to tell clinically which is the anterior

and which is the posterior surface of the uterus, as on account of its then having a somewhat spherical shape there is often not much antero-posterior flattening. When the placenta is situated in the lower zone of the uterus the anterior and posterior walls can often be well felt. In such cases the palpation of the ovaries will be our guide to its position. Their relations to the puerperal uterus we shall immediately consider. The round ligaments can also be felt in most cases. Chaignot says, "The old lateral borders and angles of the uterus are only marked in the puerperal condition by the different parts of the appendages which are fixed to them."

I have myself observed repeatedly marked lateral rotation of the post-partum uterus, and since my attention has been specially directed to the subject, I have, in nearly every confinement which I have attended, been able to assure myself that such rotation existed. I am thus confident, alike from my own experience clinically and from the records of others, that in by far the majority of cases the uterus in the third stage of labour and immediately post-partum lies obliquely in the pelvis with its left edge forwards, and that this state of matters is much more common at both these times than in any other circumstances. I have often observed right lateral rotation of the uterus in the third stage where rotation could not be definitely made out during labour, and my experience is that right rotation occurs in the third stage just as frequently after right occipito-posterior (O.D.P.) as after left occipito-anterior (O.L.A.) cases.

Where the abdominal walls are very thick it is difficult to satisfy oneself exactly as to the position of the uterus, and it has chiefly been in such circumstances that I could not make sure as regards the existence of rotation.

There is no doubt, then, that although in the non-pregnant condition there is a certain amount of rotation of the uterus, yet that this rotation is greatly increased during pregnancy, especially in the later months, and persists during the early days of the post-partum period.

The uterus is rotated to the right in probably between 80 and 90 per cent. of cases, and one may practically assume that when the foetal vertex, face, or breech present in the right oblique diameter of the pelvis, the uterus will at the same time be rotated to the right. The one condition may be regarded as almost the corollary of the other, as the rotation of the uterus greatly determines the position of the presenting part.

II. THE OVARIES, AND THEIR RELATION TO THE UTERUS BEFORE AND DURING PREGNANCY.

Each ovary in the unimpregnated condition is situated at the entrance to the true pelvis, about two centimeters from the corresponding horn of the uterus. Hasse describes the long axis of the

ovary as lying transversely in the pelvic cavity, with slight obliquity, the opposite organs diverging anteriorly. Sehultze has asserted that the long axis of the ovary lies antero-posteriorly in the pelvis. His, from his more recent investigations, believes the truth to lie between these statements. He never found the uterus symmetrically in the middle line. When the uterus inclined to the right, the right ovary lay with its long axis completely vertical, and with one side closely applied to the outer bony wall of the pelvis; but the left ovary, being dragged upon by the uterus, lay obliquely in the pelvis.

From these observations His deduces that uterine rotation will still further exaggerate these respective changes in the ovaries, and that as a consequence to changes in position of the uterus displacements of the ovaries ensue.

Rouget and Krause have observed that in consequence of the asymmetry of the uterus, the right ovary is on a plane a little posterior to the left ovary, which latter is in front and on a higher level. They describe the left ovary as lying close to the abdominal wall, through which it may be compressed in the middle of a line which would stretch from the anterior and superior iliac spine to the symphysis pubis. Posteriorly, according to them, the right ovary is separated from the sacro-iliac articulation by a space of about two centimeters.

Portal has also recorded a difference in height between the two ovaries—the left being on a higher level than the right. This may be the case before pregnancy, but in my experience this only holds good during pregnancy or post-partum, when the uterus is very much lateriverted to the right, so as to tilt up the left ovary. When the uterus is replaced in the middle line the right ovary is usually at a higher level than the left.

Kölliker believes that there is a great physiological variation in the position of the ovaries, but, according to Olshausen, the only change of importance which the ovary undergoes physiologically is its ascent during pregnancy. He says, "In advanced pregnancy one or both ovaries (generally the left) are often felt high up above the pelvis, and in close apposition to the uterus. This is also true of the puerperal period, but the ovaries resume their original position about the twentieth day after confinement."

Rouget well says, *à propos* of the rotation of the uterus, "The effect of this rotation is to alter the position of the ovaries. In pregnancy, owing to the shortening and splitting up of the broad ligaments, the ovaries are in much closer contact with the uterus than in the unimpregnated condition. They rise up into the abdominal cavity as the uterus enlarges, and immediately after labour are on a level with the brim of the pelvis."

There are two important points to be noted about the position of the ovaries in pregnancy,—firstly, that post-partum their distance below the fundus uteri is not nearly so great as in the full-time

gravid uterus. After labour the ovaries bear much the same relation to the uterus, so far as distance below the fundus goes, as in the non-pregnant state. The ovaries in a full-time pregnancy, according to Chaignot, are at the middle or at least the superior third of the uterus. Secondly, the ovaries lie in close contact with the lateral walls of the uterus, owing to the shortening and splitting up of the broad ligaments. Their mobility is consequently greatly diminished, but has not entirely disappeared. Charpentier finds that they become vertical, and almost touch the uterus.

Tarnier, Budin, Auvard, and E. Martin, in speaking of the Cæsarean operation, all mention as a danger to be remembered, that the left ovary, owing to the rotation of the uterus, may be found lying under the median incision. Martin says this is most apt to occur in lordosis, and he cautions the operator against accidentally injuring the left appendages, and so giving rise to troublesome hæmorrhage. Tarnier and Budin record cases in which this has happened.

Freund has likewise observed that in consequence of rotation, the left border of the uterus with the annexa approximated more closely to the abdominal wall.

In Winter's frozen section, which I have already referred to as an example of right lateral rotation of the uterus, he describes the position of the appendages thus:—"The conjunction of the left tube is completely to be seen in front. It is 21 centimeters above the upper edge of the symphysis. From this the tube runs straight down in front of the ovary, and surrounds it below and behind. The ovary lies close to the side edge of the uterus, four fingers' breadths above the symphysis. The right ovary lies somewhat higher, hidden behind the uterus. The right tube is invisible in its upper course, and appears first beneath the ovary. The left round ligament runs considerably nearer the median line than the right."

Schroeder and Stratz likewise confirm, from their own observations, the fact that as a consequence of the rotation of the uterus the ovaries follow its movements, and so one lies more anteriorly and the other more posteriorly. They have also observed that in consequence of the ante flexion of the puerperal uterus, and the relaxation of its appendages, the ovaries fall forward over the tubes.

Condition of the Ovaries during Pregnancy.—There can be no doubt but that the ovaries increase in size during pregnancy. Murat, Velpeau, and Chereau say they are softer and more voluminous; Courty, Joulin, and Cazeaux say they are notably augmented; while Stoltz, Jacquemier, Tarnier, and Chantreuil say they are doubled in size. The ovary which contains the corpus luteum is always the bigger of the two.

Nervous Supply of the Ovaries.—The uterus and ovaries have a very rich nerve supply. The nerves are derived from four

sources:—(1), The spermatic; (2), the hypogastric; (3), the conjoined hypogastric and sacral; and (4), the internal pudendal.

The ovarian plexus is an appendage of the renal plexus, and accompanies the ovarian artery; at the level of the hilum its branches penetrate with the vessels into the interior of the gland, and ramify themselves in the cortical zone. Gaskell finds that cerebro-spinal nerves pass to the hypogastric plexus, and thence to the uterus and ovaries by visceral branches of the 2nd and 3rd sacral nerves, which form part of the pelvic splanchnics, and are known as the *nervi erigentes*. The sympathetic fibres, on the other hand, pass to the inferior mesenteric ganglion along the *rami efferentes* of that ganglion, and thence to the hypogastric plexus.

Elischer finds that the nerves of the ovary enter into its substance in the form of medullated fibres, accompanying the looped and tortuous vessels that pass to the hilum, and run also in the proper ligament of the ovary.

Frankenhäuser and Jastreboff have shown that the nerves and ganglia of the uterus and ovaries increase in number and size during pregnancy.

Braxton Hicks, after remarking how intimately the uterus and ovaries are connected with the sympathetic nervous system, and how they are almost entirely supplied by ganglionic nerves, goes on to say that the nervous structures and ganglia grow and increase in pregnancy; that the susceptibility of the uterus is increased, and its reflex phenomena more marked.

Vascularity of the Ovaries during Pregnancy.—Velpéau says that during pregnancy the bloodvessels of the ovary dilate, sometimes to the point of rupture. Roux, Murat, and Chéreau say that there is a spongy state of the organs in pregnancy, due to the augmentation of calibre of their vessels, which bring blood to them in greater abundance. Chéreau and Hervieux rely on this physiological congestion to explain the frequency of puerperal ovaritis. Churchill and Stoltz also believe that there is increased blood-supply. Bischoff and some others have denied this engorgement of the ovarian vessels in pregnancy.

It seems to me, however, that all the evidence is in favour of increased blood-supply during gestation. The ovaries are supplied from the same arterial trunks as the uterus, and if there be not active congestion, there will be at least passive congestion, as may be seen in the rectum, vulva, and lower limbs.

Devalz and Richet have described varicose dilatations of the bulb of the ovary in the broad ligament during pregnancy, which from excessive distention have even ruptured, causing a variety of peritoneal hæmatocele. They believe this ovarian varicocele to be the result of the frequently repeated congestion at the menstrual epochs.

Sensitiveness of the Ovaries during Pregnancy.—Loumagne and Puech deny the sensitiveness of the ovary in the normal state.

They base their assertions on cases of hernia of the ovary. In their cases, however, the ovaries had become atrophied, and consequently were not tender to touch.

Guersant and De Coste have observed cases of ovarian hernia in which "the sensation of pain on pressure was similar to that of a testicle" (Chaignot).

Percival Pott's well-known case of double ovarian hernia shows that in a healthy woman the ovaries were exceedingly tender on the least pressure.

Hegar and Kaltenbach also show this, and Murat likewise adduces instances of the tenderness of healthy ovaries.

Puech thinks that the ovaries are only tender in what he calls abnormal conditions, as when they are congested in menstruation.

Professor Courty of Montpellier writes as follows:—"La *sensibilité normale* de l'ovaire est exquise (elle n'a pu être niée que par des médecins inexpérimentés); sa sensibilité pathologique est développée à un tel point que la moindre pression y provoque des douleurs atroces."

There can be no doubt that congestion, whether active or passive, will make the ovaries more sensitive to external pressure, and pregnancy certainly fulfils this condition.

After thus considering the position of the uterus and ovaries in pregnancy, one is impressed with the fact that in consequence of the uterine rotation so commonly to be observed, one of the ovaries (usually the left) is brought close under the abdominal wall, and consequently might possibly be injured by pressure through the abdominal wall. There can be no doubt that the ovaries during pregnancy are very sensitive, and pressure upon them causes pain which is sometimes very severe.

Budin has recorded some very interesting cases which prove this. He has noticed that in palpating the abdomen in pregnancy he has sometimes found moderate pressure with the fingers on the abdomen produce very sharp pain. The pain was clearly localized, was distinctly produced by the pressure of the fingers on one spot, and caused the patients to groan or cry out. Pressure on the neighbouring parts was not in the least painful. At the spot where the pain was felt, a small body moved below the finger, being movable transversely but not perpendicularly. Its form was oval, its great axis usually vertical, but sometimes oblique from above downwards and from within outwards, and its size was generally about that of an olive. This Budin believes to be the ovary. It is nearly always to be found on the left side near a line drawn from the umbilicus to the anterior superior spine of the ilium. A resisting surface, generally the foetal back, allows the pain to be more readily provoked and the movable body more easily to be found. Budin goes on to say that the ovary is to be felt to the left and forwards on account of the rotation of the uterus during pregnancy, which brings its left border forwards, and

by the foetal back being to that side. He does not say how many cases he had investigated, but that "in only two of the many cases" which he has observed was the right ovary to be felt to the right side and forwards, and in these cases the foetal back was also forwards and to the right.

If the uterus contract, it is easy to produce by pressure a sharp localized pain, and to feel the ovary rolling beneath the fingers. When contraction ceases, this is often more difficult. The round ligament may be felt rolling under the finger, but it is painless on pressure, and is not oval in shape, but more like a cord. None of Budin's cases were hysterical.

Budin proved that this tender oval body as described was really the ovary in a case in which he had palpated it previous to a Porro's operation. Both Tarnier and he found before the operation the ovary lying to the left and towards the middle line of the abdomen; it rolled under the finger, and was painful when pressed. When the abdomen was opened the first part of the uterus which presented itself was the left border with the ovary adhering, and they proved that it was it which they had previously felt through the abdominal wall.

Chaignot, in less than three months, made thirty consecutive clinical investigations on hospital patients, and found that abdominal palpation employed at the end of pregnancy may produce on the sides of the uterus in a certain number of women a sudden and sometimes very sharp pain. He has identified this pain with pressure on the ovary, and he finds that it is most easily produced when the ovary lies on a resisting surface, such as the back of the foetus or the contracting uterus. "The pain is felt most frequently to the left, owing to the torsion of the uterus bringing forward its left lateral edge."

Its usual position, according to Chaignot, is near a line drawn from the anterior superior spine to the umbilicus, usually a few centimeters above it in the last month of gestation. The average distances are as follow:—8 to 10 centimeters from the anterior superior spine; 17 to 19 centimeters from the umbilicus; 6 centimeters behind the prominence formed by the round ligament.

	Left Side.	Right Side.
	Centimeters.	Centimeters.
Distance from anterior superior } iliac spine, }	9 to 10	7 to 8
Distance from umbilicus, . . .	17 to 19	18 to 20
Distance from round ligament, .	5 to 6	5 to 6

I have made a short abstract of Chaignot's cases, which I here append:—

23 Cases—*Ovary felt on Left Side.*—17 were O.L.A. throughout. 3 were O.L.A. with left ovarian pain to begin with. One changed to O.D.P., and the left ovarian pain changed to right ovarian pain. One changed to O.L.P., and the pain on pressure disappeared, and the ovary likewise ceased to be felt. One changed to O.D.P., and the ovarian pain, though still in the same place, was not nearly so sharp. 3 were O.D.P. throughout.

3 Cases—*Ovary felt on Right Side.*—3 were O.D.P. throughout.

4 Cases—*Ovary felt on Both Sides.*—2 were O.L.A. One was a hysterical patient; the foetus was very large, the uterus was inclined to the right, but there was no rotation. The other showed right lateral inclination and slight right rotation. The right ovary could only be felt during a pain, as it was further back. 2 were O.D.P. There was no rotation in either case. In one there was no lateral inclination.

Analysis of Chaignot's Cases.

The vertex of the foetal head lay with its long diameter in the right oblique diameter of the pelvis in every case to begin with (one changed to O.L.P. afterwards):—

22 primary O.L.A. in 30 cases	=73·4 per cent.
8 primary O.D.P. in 30 cases	=26·6 ,,
23 cases had left ovarian pain	=76·7 ,,
3 cases had right ovarian pain	=10 ,,
4 cases had double ovarian pain	=13·3 ,,

Chaignot believes that the reason why, in right occipito-posterior cases, the anterior ovary cannot well be felt to the left is because there is no resisting foetal back to press it against. He believes that "the size of the foetus, multiple pregnancy, nervous and irritable temperament, and hysteria, are among the conditions which favour the appearance of ovarian pain, and especially its intensity."

Chaignot has likewise sought for the ovaries post-partum within eight or ten days, but he has never been able to make them out definitely except once,—“as the hard resisting plane of the uterus is then wanting, and it would require very deep palpation.” He has provoked ovarian pain by pressure during the puerperium, which was always felt several centimeters below a line drawn from the anterior superior spine to the umbilicus; and the less recent the delivery, and the more retracted the uterus, the deeper the pain is. When he found ovarian pain after delivery, it was generally during the first days. The furthest period at which he could produce it was the eighth or ninth day. His conclusion is, that the ovarian pain produced by pressure during pregnancy can be reproduced after delivery.

Féré records two cases of pregnancy and labour in hysterical women who were delivered in a state of trance. In both cases he could palpate the ovaries, which were very tender on pressure.

He watched the tender spots ascend with the uterus during pregnancy, and descend with it after labour. The left ovary was the one best felt, and there was ovarian pain on pressure post-partum.

Charcot has noted that in hysterical women, although the microscope has not yet discovered any special anatomical lesion, the ovaries are the seat of a swelling which renders them more accessible to exploration.

I have myself been able repeatedly to palpate the ovaries during pregnancy, and in every case even moderate pressure elicited pain.

The palpation of the ovaries, which we have hitherto been considering, has, however, been comparatively gentle; and in many cases the ovaries were the objects for which the palpation was made, all pressure immediately being removed as soon as ovarian pain was elicited.

The uterus in the third stage of labour is, however, often subjected to a much more severe form of palpation, a palpation which is necessary either for the purpose of stimulating it to contract firmly, or for hastening the expulsion of the placenta from its cavity. In many cases this palpation, or rather compression, requires to be very energetic and prolonged; and I am of opinion that this compression, which is only intended for the uterus, includes sometimes one or both ovaries as well, and that they in consequence may be injured in the third stage of labour by forcible compression against the contracted uterus.

(1.) In the third stage of labour the ovaries, as we have seen, lie close to the fundus uteri, and so the hand grasping the fundus could easily grasp the ovaries at the same time. The conditions are different to what they were before the expulsion of the foetus, for then the fundus is far distant from the ovaries, and firm pressure can be made upon it (as is sometimes done in *expressio foetus*) without fear of including the annexa.

(2.) The pressure is often pretty vigorous in the third stage.

(3.) The rotation of the uterus, causing in the majority of cases the left ovary to come forwards towards the middle line, makes the ovary more liable to be grasped.

(4.) The ovaries in the third stage are lying just at the brim of the pelvis, and the left ovary is apt to be squeezed or pinched between the bony pelvis and the hard contracted uterus if forcible pressure downwards be made in an awkward application of Credé's method.

In a previous paper I have already detailed three cases which came under my notice in practice, in which intense pain was experienced during the compression of the uterus in the third stage, followed by a further development of remarkable nervous phenomena, terminating in well-marked shock, in which I ascribed the condition to pressure on the ovaries. From that paper I quote the following paragraph:—

“I have repeatedly seen an analogy to this occur in cases of

abdominal section for the removal of the ovaries and Fallopian tubes. If, as sometimes happens (especially in cases of fibroid tumour with healthy ovaries, or where diseased appendages are not easily brought to the surface), the ovaries should be somewhat roughly handled or accidentally torn, say by a pair of forceps, before the ligature has been tied, it is a matter of common observation that the patient, though fully anæsthetized, in the majority of cases becomes affected by modified shock. The pupils dilate, the face becomes deathly pallid, the extremities cold, a clammy perspiration breaks out, the pulse flutters, and the respirations become shallow and irregular. These symptoms pass off when the ligature is tightened and the organ removed. If such a condition happens when atrophied, cystic, or even eirrhotic ovaries are irritated, how much more is it likely to occur when the large, congested, tender ovaries of pregnancy are forcibly compressed against the hard post-partum uterus, and when the patient is either not under the influence of an anæsthetic or is only partially anæsthetized."

The following are three cases in detail to illustrate this :—

(1.) I. B., æt. 26, suffered from double salpingo-oöphoritis. Abdominal section was performed in the Royal Infirmary on 19th May 1886, and both ovaries and tubes were removed. The appendages on the left side were adherent and difficult to reach. When brought to the surface the pedicle was very short. The ovary was seized by a pair of Spencer Wells' forceps to hold it up while the ligature was applied. Immediately the patient's breathing became affected, the pulse fluttered, the face changed in colour, becoming bluish white, and a cold perspiration broke out. The patient was all the time fully, but not too deeply, anæsthetized, and her condition became quite satisfactory after the ovary was removed.

(2.) Mrs T., æt. 31, suffered from double salpingo-oöphoritis with extensive adhesions. Abdominal section was performed in the Royal Infirmary on 2nd June 1886. Great difficulty was experienced in getting the appendages of the right side to the surface, and eventually only the tube was got away. The ovary and tube on the left side were both removed easily. The left ovary was grasped by a pair of forceps before the ligature was tied. The patient, who was breathing quietly and steadily at the time under the influence of ether, and with a good colour in her face, suddenly gasped, became deathly pale, retched violently, and manifested all the symptoms of shock. On the removal of the ovary she quickly recovered, and her condition remained satisfactory till the end of the operation, from which she made a good recovery.

(3.) Mrs W., æt. 36, suffering from a bleeding fibroid tumour of the uterus, reaching one finger's-breadth above the umbilicus. The sound passed 5 inches into the uterus. The ovaries and tubes were

removed on 4th April 1887 in Ward XXVIII., Royal Infirmary. The ovaries were found practically sessile on the uterus, owing to the shortening and splitting up of the broad ligaments by the fibroid growth. Ordinary ligatures could not be applied; the clamp and cautery were used. Each time the clamp was applied the patient manifested symptoms of transient shock, similar to those already described. The clamp included a small portion of each ovary in its grasp, and very soon after it was thoroughly tightened the symptoms disappeared.

Curiously enough, the fibroid uterus in this case was rotated so that the left ovary lay almost immediately under the incision. The tumour had to be considerably rotated round to the left before the right ovary could be reached.

Amand Routh has found that "dilatation of the cervix by bougies, tightening the serre-nœud in hysterectomy, tying the pedicle in ovariectomy, sponging out Douglas's pouch, or freeing matted ovaries and tubes from their adhesions, are all similar in being liable to produce shock, intermission or omission for two or three beats of the pulse, and temporary cessation of respiration. Vomiting is also apt to be set up by rapid dilatation. All these phenomena are lessened by deep anæsthesia, which usually allows the operation to be proceeded with. In one case the operation had to be discontinued."

We can further find a similar analogy to this in the case of the testicles. Both the ovaries and the testicles are richly supplied with nerves, derived in each case from the great sympathetic system.

Valentin has clearly established the homology of these organs. He says:—"The first origin of the ovary and testicle is entirely analogous, and both develop in the same way for some time, until the period when a different character indicates itself, when the continuation of the development of a tubular gland ceases in the ovary, and the characteristics of its first structure become more and more difficult to distinguish."

Instances of shock occurring after injury to the testicle are very numerous.

Pirogoff speaks of a judicial case where death by shock speedily followed upon intentional crushing of both testicles. The section showed only extravasated blood in the tunica dartos and under the albuginea.

Erichsen has observed during castration, at the moment of cutting through the spermatic cords, a sinking of the pulse, even when the patient was completely anæsthetized, so that it seemed better to stop using chloroform at the moment.

Fischer has observed shock resulting from the too tight strapping of inflamed testicles.

Vincent records a case of passing shock after a kick on the testicle, and Hosteing a similar case after crushing of the testicle on the saddle.

Pelikan has shown that bruises of the testicle or spermatic cord are more apt to produce shock than clean wounds.

Hunter saw a sudden death during castration, and dangerous convulsions during an operation for hydrocele.

Why, then, should not shock occur just as well after bruising of the ovary as it does after bruising of the testicle?

Any strong irritation of the peripheral sensitive nerves, or of the sympathetic nerves, is capable of engendering a condition of exhaustion of the spinal cord, which manifests itself in weakening of motility, sensibility, and reflex power, and in a depressing influence on the heart and respiration.

Shock is a functional disturbance, and has no real pathological anatomy, though after death there is sometimes to be found enormous distention of the abdominal bloodvessels, supposed to be due to paralysis of the splanchnic nerves.

The theories as to the production of shock are endless. Irritation of the vagus, simple paralysis of the heart, or reflex, partial, or general vascular paralysis, cannot wholly account for it. The attempts to explain it by saying that it is due to contraction of the small arteries, or to changes in the composition of the blood, have not been proved. In short, the vascular apparatus and its contents give no satisfactory explanation of shock. The only satisfactory hypothesis, according to Groeningen, is "that which occupies itself with the whole sphere in which the appearances we have considered originate." The most feasible explanation is that shock is an exhaustion of the medulla and of the spinal cord, caused by violent injuries. The irritations which influence sensitive nerves can be classified, according to the resulting excitement, into four stages (Groeningen):—

(a.) The lowest stage is ineffectual. The excitement does not go beyond the threshold of consciousness, and evokes no other appreciable effect.

(b.) The middle stage destroys (*auslösen*) the proportionate feeling.

(c.) The strong stage effaces the fineness in the feeling of quality, and permits the feeling of pain, or one akin to it, to come into the foreground.

(d.) The highest destroys every feeling, fugitive or lasting.

The lower stage of irritation, applied with or immediately after a higher one, remains without effect; or, as Fourneau Jordan well puts it, "Shock is to a certain extent a protection against shock."

Every excitement of a nerve calls forth in itself, as well as in the central organs, a change tending to fatigue; the collective appearances of reflex stoppage, and of reflex paralyses, are thus explained in a satisfactory way.

Brown-Séguard believes that irritations of nerves may produce three kinds of shock:—

1. Shock where reflex arrest or diminution of the heart's action predominates.

2. Shock where there is a peculiar inhibitory influence on the central organs of respiration, the heart continuing to beat with more or less vigour.

3. Where a powerful influence is exerted by the nervous centres on the nerves able to act on circulation, secretion, and nutrition, so as to produce a cessation of most, if not all, the ordinary interchanges between blood and tissues. In this third form of collapse the bloodvessels are generally contracted; there is always a diminution of breathing, and a weak, sometimes slow, pulse.

Watson lays special stress on the fact that shock is determined in intra-peritoneal operations from reflex action by irritation of the sympathetic.

Kaltenbach considers reflex paralysis of the heart to be the essence of shock in abdominal operations. He goes on to say that in the milder cases the symptoms of shock subside as soon as the cause is removed,—for example, after the cessation of extensive manipulation of the intestines. In some cases, however, the patients die during the operation, or within three or four hours afterwards.

The splanchnic is the vasomotor nerve of the intestinal bloodvessels, so that it governs the largest muscular area of the body; it is likewise the sensory nerve of the intestine, and under certain circumstances it may give rise to very painful sensations. According to Landois and Stirling, the trigeminus and splanchnic nerves are the most sensitive to pain in the whole body.

Fourneau Jordan, in his classical essay on Shock, says, "The peculiar condition which more than any other influences shock is the susceptibility or excitability of the nervous system."

Injuries of the abdominal viscera are always marked by extreme and severe shock. This is to be explained by the impression made upon the cerebro-spinal system through the medium of the ganglionic. Women are probably more influenced by reflex irritations than men, and are liable to a severer form of shock.

Conditions which may simulate Post-partum Shock.

(1.) *Syncope from Hæmorrhage*.—There is no doubt that not only are syncope and shock often associated with one another, but also that the manifestations of shock are frequently intensified by the co-existence of hæmorrhage, which may or may not have gone so far as to produce syncope. At the same time the two conditions are quite separate and distinct, and in the majority of cases are easily distinguished from one another. There has been and still is a great deal of confusion on the subject; some writers under the title of "Collapse" including both conditions, and others drawing hardly any distinction between them. This confusion is mainly due, I think, to the many pathological theories which have been advanced regarding the nature of shock, most of which were

erroneous, and calculated to mislead the clinical observer. I feel sure that the two conditions are frequently confounded, and that many cases of shock after labour are erroneously described as arising from the effects of hæmorrhage. I shall have occasion again, however, to refer to this point.

Nothnagel has very clearly pointed out the differences between syncope and shock, and I cannot do better than quote some remarks he makes with regard to their differential diagnosis. He says:—"After successful delivery, profuse hæmorrhage occurs on account of faulty contraction of the uterus. If energetic measures be not taken at once, all the symptoms of fainting appear, and there accompany them, with or after fainting, the strongest general convulsions, very like epileptic. The symptoms are oppression, sighing and rapid respiration, yawning, paleness of the face, increase of oppression with giddiness, feeling of general torpidity, cold perspiration, singing in the ears, sickness, and inclination to vomit; the sight is darkened, and the surrounding voices cannot be heard. The pulse is regular, but small and of low tension, and there is quick recovery as a rule.

"Shock is quite different from this. In pure shock there is no singing in the ears, no oppression, no giddiness, no darkening of the sight. There is irregular, weak, and rapid pulse, and irregular breathing. There is no twitching of the muscles, no epileptic convulsions, not such a marked loss of consciousness, and no quick recovery."

In the torpid form of shock the senses and consciousness are benumbed, the eyes are dull, vacant, and motionless, with dilated pupils, and there is subnormal temperature. The patient at first complains of coldness and numbness of the limbs, and often the sphincters are relaxed, and there may be a tendency to nausea and vomiting. Shock usually produces a degree of syncope as well. In my cases the complete unconsciousness was undoubtedly due to syncope which was superadded to the shock. In all cases careful investigation must be made as to the existence of hæmorrhage, concealed or otherwise.

(2.) Shock has also to be distinguished from the effects of an overdose of ergot or ergotin. I have once seen such a condition, where undoubtedly more ergotin had been administered to a patient than was either necessary or safe. The patient complained of giddiness and loss of sensation, and the respirations were shallow and slow. There had been hardly any hæmorrhage in the third stage, but the uterus was flabby, and the ergotin had been given mainly from a prophylactic point of view. These symptoms soon passed off after free stimulation. The pulse was not affected. Lauder Brunton has found that a solution of Bonjean's ergotin injected into animals causes an affection of the nervous system indicated by inco-ordination, anæsthesia, and paralysis, and death is due to paralysis of respiration. The muscles are unaffected, and

the motor nerves are not paralysed. The sensory nerves and spinal cord are paralysed. Ergot acts directly on the inhibitory apparatus in the heart itself, and tends to slow it and ultimately to stop it in diastole. There is usually a rise of blood-pressure at first from its stimulating action on the vasomotor centre in the medulla, and owing to the firm contraction of the intestines and uterus rendering them devoid of blood, an extra quantity of blood is thrown into the rest of the circulation.

(3.) The uræmic coma, so often seen in puerperal eclampsia, is easily diagnosed from shock by the history of the convulsions, the nature of the pulse, and the state of the urine.

(4.) Pulmonary emboli from venous thrombosis are the commonest cause of collapse and sudden death in the post-partum state, and might be mistaken for severe shock. Sudden dyspnœa and orthopnœa usually indicate this condition. Wernich has recently stated that in his opinion so-called shock is often due to small emboli.

(5.) The entrance of air into the veins immediately after delivery causes symptoms very similar to pulmonary embolism. Asphyxia and collapse usher in death.

(6.) Collapse and possible sudden death may occur after labour as a result of pre-existing disease which has been aggravated by the labour. For example, I have seen two cases where collapse and death followed soon after labour in patients who were suffering from mitral stenosis, and Barnes records a case of sudden insensibility followed by death, where post-mortem a hæmorrhage was found to have taken place in the left optic thalamus.

(7.) Collapse or sudden death may likewise occur post-partum from totally accidental causes, as, for instance, in a case of Simpson's quoted by Auvard, where death rapidly followed the rupture into the peritoneal cavity of a large hepatic abscess.

Hysteria and epilepsy must also be kept in mind as possible causes of insensibility after labour.

*Prevention of the Form of Post-partum Shock which we have
been Considering.*

Clearly the way to prevent the occurrence of the shock is to avoid bruising the ovaries in the management of the third stage. I have been unable to find any description of such a danger as this in the application of Credé's method. The only authors who mention anything about pain in the third stage are Riou and Spiegelberg. The former says, in speaking of expression of the placenta,—“The most serious of the inconveniences of this proceeding is certainly the pain produced—a pain which is sometimes not considerable, but which sometimes becomes tolerably acute if expression be practised for a long time, and which obliges the accoucheur to have recourse to another method of deliverance.

When the uterus is soft and flabby pain is often produced by long compression, which is so sharp that the patient can no longer bear the action of the hand. Where a great deal of vigour is necessary to expel the placenta the pain is sometimes so great that one must cease to express. There are some women also, timid or nervous, sensitive and delicate, who cannot bear the action of the hand on their abdominal walls, and this pressure, even when slight, causes sharp pain, and sometimes even cries, which necessitate the employment of another means. I have, however, seen women who could not bear the manœuvres of expression to begin with, and who after a few minutes' rest permitted a second and a third attempt, which were always followed by success. Other women, it must be said, prefer uterine expression to any other means of deliverance."

Neither Riou, however, nor any other writer say a word of the ovary in connexion with the pain.

How can we make certain of not including one or both ovaries in our grasp of the uterus during the third stage? Clearly by grasping the uterus antero-posteriorly, and avoiding its lateral borders. Now, in all the descriptions of Credé's method¹ this point is not made perfectly clear. It is implied, perhaps, but it is not stated. The directions given have all a reference to landmarks in the pelvis, not to the position of the uterus. We are told in effect, by all, to pass the ulnar side of the hand down in front of the promontory, the entire hollow of the hand lying on the fundus, and the thumb on the anterior uterine wall behind the symphysis pubis (Spiegelberg, Playfair, Lusk, Charpentier, Grandin, etc.)

Credé and Mundé figure the hand grasping the uterus with the thumb behind the symphysis pubis, and the fingers in front of the promontory of the sacrum. Now, I contend that if the compressing hand be in this position the uterus is not, as a rule, grasped antero-posteriorly, and that the ovaries are consequently in imminent danger. In other words (as we have already seen), *that the term antero-posterior quâ the pelvis is not antero-posterior quâ the uterus in the great majority of cases.*

To avoid the danger of toneling the ovaries, and to make sure of grasping the uterus antero-posteriorly, the hand should be passed into the brim of the pelvis obliquely, and as we can infer that in at least 90 per cent. of cases the uterus is rotated to the right, the ulnar side of the hand should be pressed deeply down in the direction of the left sacro-iliac synchondrosis, while the thumb should be behind the right ilio-pectineal eminence, the fundus of the uterus resting in the hollow of the palm.

In the vast majority of cases such a grasp of the uterus will entirely avoid the ovaries, and firm compression can safely be made without causing the patient much pain or inconvenience.

¹ When I speak of "Credé's method" in this paper, I only mean his method of grasping the uterus, which is the type of the universally accepted "Hand-griff."

The reasons why the ovaries are not more frequently injured in the management of the third stage of labour are:—

(1.) The uterus has usually been grasped obliquely as above described, though the fact has not hitherto been recognised, and has escaped observation. When a patient is lying on her left side in the usual obstetric position, it will be found that the operator's left hand involuntarily grasps the uterus in an oblique direction *quâ* the pelvis, and that the attempt to grasp it in an antero-posterior direction *quâ* the pelvis involves a twisted and constrained position of the hand which it would be impossible to keep up for any length of time, and would absolutely prevent the bringing into play of any degree of muscular force. Any accoucheur can prove this for himself in his daily experience. From this it will be observed that when the patient is lying on her left side especially, the accoucheur naturally grasps the uterus obliquely *quâ* the pelvis, and consequently antero-posteriorly as regards itself, so that the ovaries usually escape danger. Even when the patient is lying upon her back it will be found that the hand naturally sinks into the pelvis obliquely in the same way. The common practice, then, in the application of Credé's method, seems to be that the hand is not antero-posterior *quâ* the pelvis, but that it is antero-posterior *quâ* the uterus. In other words, that the safe grip of the uterus which I advocate is the one usually employed, and that the ovaries have hitherto escaped compression more by good chance than by good guidance.

It is just possible that in consequence of this fortuitous circumstance injuries to the ovaries are more apt to take place when the uterus is either not rotated at all, or where there is rotation to the left.

(2.) Not infrequently, in grasping the uterus in the third stage, even a very slight pressure provokes pain, in all probability ovarian in its nature. The accoucheur in such a case naturally changes his grip, and usually the alteration in the position of the hand relieves the patient from pain, and enables firm compression to be made with little or no discomfort. This sufficiently accounts for Rioli's observation quoted above.

The ovary also, owing to its lateral mobility, may slip away from beneath the compressing fingers, and thus escape injury or be but slightly irritated.

In palpating the abdomen in pregnancy the ovary is often to be felt slipping away, as it were, under the fingers.

(3.) If the anterior and posterior surfaces of the uterus are well marked and easily felt, the accoucheur naturally grasps it antero-posteriorly, and alters its position to suit his hand. Sometimes the ovaries can be felt, and thus one is enabled to avoid them.

(4.) It must be remembered that in many cases the employment of the hand through the abdominal wall is simply a precautionary measure for the purpose of detecting and preventing relaxation of

the uterus. In these circumstances no great pressure is requisite, and the ovaries, even though touched, are consequently not endangered by too great pressure. Spiegelberg mentions that when compression of the uterus requires to be forcibly done it is often very painful. This, however, does not require to be done very frequently, he remarks, if the third stage be managed properly, and time is given for the natural separation of the placenta to be effected.

Possible injuries to the ovaries during the compression of the third stage must not, however, be left to the determining influence of practically accidental circumstances, but the accoucheur should have a clear idea that if he grasp the uterus in a certain way he will, as far as it is possible to do so, avoid coming in contact with the ovaries. He will, I think, succeed in doing this in most cases by practising the oblique grasp which I have described.

In this connexion I again quote two paragraphs from my previous paper on post-partum shock. If a patient should complain of severe pain during the manipulation of the post-partum uterus, one should always fear that the ovaries are being compressed at the same time. It depends on the temperament of the patient to a great extent, as well as on the amount of bruising to which the ovaries are subjected, whether the symptoms produced by compression of the ovaries will be severe or not. True, it is not often that such alarming reflex symptoms occur as were observed in the three cases which I have recorded, yet there can be no doubt that the ovaries should, as far as possible, be guarded from all sources of irritation, and that every care should be taken to prevent their being injured during the third stage of labour, and immediately post-partum. The injury inflicted on the ovary may not be, and seldom is, so great as to produce shock, but may it not (and I merely throw out this as a suggestion) account perhaps in some measure for some of the low forms of inflammation and other pathological conditions so frequently met with in the ovaries as a result of the puerperal state.

The ovaries undoubtedly run greater risk of being injured in the hands of those who "Credé" the ovaries on no special principle, without regard to the axis of the pelvis, and who are only too glad to get the placenta squeezed out in any way, often immediately after the end of the second stage. But it will be said no such cases have been recorded.

One, however, occasionally reads and hears of cases where so-called syncope has come on in the third stage or immediately thereafter. The uterus had been a little relaxed, and there had possibly been a slight threatening of hæmorrhage. The syncope is ascribed to the trifling loss of blood, often not in excess of what one would expect in a normal labour, instead of being put down, as I think in many cases it should be, to the energetic and forcible kneading which the ovaries, along with the uterus, have been

subjected to in the over-zealous but well-meaning efforts of the accoucheur to avert a more or less visionary post-partum hæmorrhage, the so-called syncope being the result of shock, pure and simple.

There is only one condition, so far as I know, where the post-partum uterus should, if possible, be grasped laterally through the abdominal walls, and that is in the operation for washing out its cavity. The lateral grasp is for the purpose of compressing the Fallopian tubes in order to prevent any of the fluid from passing through the tubes into the abdominal cavity. The compression in such cases requires only to be very gentle, so that there is little fear of injuring the ovaries.

Other Causes of Post-partum Shock.

Shock may, of course, come on post-partum under other circumstances.

(1.) A tedious and unusually painful labour is said sometimes to account for it, especially if there be much instrumental interference. The nervous system after a severe labour is depressed by pain, starvation, and loss of sleep. Barnes records a case of shock and sudden death ten hours after labour. There was maniacal excitement in the first stage. Delivery was effected easily with forceps under chloroform. There was no post-mortem, and Barnes ascribes the death to "nervous shock which manifested itself before labour, and which was intensified subsequently."

This condition is to be diagnosed from the syncope which sometimes supervenes on the sudden emptying of a largely distended uterus. As a consequence of this sudden lowering of the intra-abdominal pressure there is dilatation of the abdominal veins, followed by temporary anæmia of the brain.

(2.) *Inversio Uteri* occurring post-partum may also cause shock. It can always be easily diagnosed. It is often brought about by improper and over-forcible compression of the uterus in the attempts to express the placenta.

(3.) *Rupture of the Uterus* usually shocks the unfortunate patient before death puts an end to her sufferings.

In one case which I know of where pregnancy was complicated with an ovarian tumour, soon after the accession of labour pains the patient became insensible and manifested all the symptoms of severe shock. On opening the abdomen a fissure was found in the peritoneum covering the side of the uterus, which seemed to account for the condition. A twisted ovarian pedicle may give rise to shock.

(4.) *Injectations into the Uterine Cavity* after labour are sometimes followed by an alarming condition of shock. This happens rarely. It is probably caused by some of the fluid regurgitating through one or both Fallopian tubes. Now, it is impossible that the mere entrance of an antiseptic lotion (or even pure water, as I have

once seen) into the peritoneal cavity can account for the condition, seeing that in abdominal operations the abdominal cavity can with impunity and great advantage be washed out with a lotion of similar strength. Simmons records a case where most alarming nervous symptoms followed in a case where he injected with plain water, and he quotes a case of Späth's where shock occurred followed by death in seventy-four hours, after the injection of a solution of acetate of lead into the vagina. The post-mortem showed, in addition to peritonitis, a sediment of sulphate of lead on the peritoneal surface of the ovaries.

The shock in such cases is, I believe, due to the reflex irritation produced by the sudden dilatation of the tubes by hydrostatic pressure, owing to insufficient care having been taken to provide for the reflux of the lotion through the cervix and vagina. It is not at all necessary for the production of this form of shock that the fluid should pass into the peritoneal cavity at all. It is not peritoneal irritation which causes the shock; it is tubal distention, and this tubal distention produces a feeling of the most intense anguish. Such cases are, of course, quite different from the form of shock which was once so common, when it was the fashion to inject strong acids and chemicals into a non-pregnant uterus in the treatment of certain conditions. The fluids injected were intensely irritating in themselves, and they were never injected in sufficient quantity to distend the tubes. They produced shock by their direct chemical action on the tubal mucous membrane, and this was shortly followed by intense inflammation and peritonitis.

CONCLUSIONS.

As a result of the foregoing statements the following conclusions can, I think, be safely made:—

1. The uterus, even in the unimpregnated condition, is usually rotated on its longitudinal axis. This rotation becomes much increased in the later months of pregnancy and during labour. In the third stage of labour and immediately post-partum the transverse axis of the uterus often corresponds to the oblique diameter of the pelvis.

2. In the immense majority of cases this rotation is to the right. The fact that the presenting part of the foetus usually lies in the right oblique diameter of the pelvis is probably due in great measure to this uterine rotation.

3. The ovaries in pregnancy are in close contact with the lateral walls of the uterus.

4. The uterine rotation consequently causes one ovary (usually the left) to lie forwards towards the middle line, and the other (usually the right) to move backwards.

5. The ovaries have a rich ganglionic nervous supply, derived chiefly from the sympathetic system.

6. The ovaries are enlarged during pregnancy; they are congested, and even slight pressure upon them, when palpated through the abdominal walls, gives rise to pain.

7. Any strong irritation of the peripheral sensitive nerves or of the sympathetic nerves is capable of engendering a series of constitutional phenomena collectively known as "*shock*."

8. There is a certain class of cases where, after labour, alarming manifestations of nervous prostration and insensibility supervene, and where there is neither hæmorrhage nor any of the other recognised causes of such a condition to account for it.

9. These cases are accounted for by injuries inflicted on one or both ovaries in the management of the third stage of labour. During the necessary manipulations at this period the ovaries run the risk of being bruised between the compressing hand and the hard uterus; or the uterus is forcibly tilted over in such a way that the anterior (left) ovary is squeezed between it and the brim of the pelvis.

10. In such cases the patients always complain of great pain, and the more forcible the compression the greater the pain, and the better marked are the reflex manifestations, amounting in certain cases to the production of shock. Such consequences are always better seen in patients of a somewhat neurotic tendency.

11. Analogies are to be found—(1), In cases of abdominal section for the removal of the ovaries, when, if these organs be much bruised in the process, symptoms of shock at once show themselves; and (2), in the shock which so frequently results from injuries to the testicles.

12. In order to avoid injuring the ovaries during the management of the third stage, the uterus must be grasped antero-posteriorly, and it must be kept in mind that *antero-posterior* quâ *the pelvis* and *antero-posterior* quâ *the uterus* are not synonymous terms.

13. If the hand be passed into the pelvis antero-posteriorly the ovaries are apt to be included in the grasp. The hand must therefore be placed obliquely in the pelvis, and then it will grasp the uterus antero-posteriorly. When much force is necessary, special care must at the same time be taken to press the uterus in the proper axis of the pelvis.

14. When the patient is lying on her left side the operator's left hand naturally sinks into the pelvis obliquely, and so the ovaries escape danger.

15. If a patient should complain of much pain during the manipulation of the uterus in the third stage of labour, one should fear that the ovaries are being compressed, and the grasp of the uterus should be changed.

16. It is often difficult to tell in the third stage of labour and immediately post-partum which is the anterior and which is the posterior surface of the uterus, as at these times it frequently presents a somewhat globular shape.

17. The only condition in which the post-partum uterus should be grasped laterally is in the operation for washing out its cavity. The grasp in such a case requires only to be very gentle.

18. Post-partum shock may be due to other causes besides injury to the ovaries.

LITERATURE.

- AHLFELD.—Einige Vorschläge zur Methodik der Vergleichenden Untersuchungen über den Werth der Credé'schen Methode, etc., *Cent. für Gyn.*, 1886, x. 841-845. AUVARD.—Travaux d'obstétrique, t. iii. p. 223; *Traité pratique d'accouchements*, 1889, p. 75.
- BALLANTYNE.—Mitral Stenosis in Labour, *Trans. Ed. Obst. Soc.*, vol. xiii.
- BANDL.—Ueber das Verhalten des Uterus u. Cervix in der Schwangerschaft u. Während der Geburt, *Arch. für Gyn.* xii. S. 334; Ueber die Normal Lage, etc., des Uterus, *Arch. f. Gyn.*, 1884, B. xxii. H. 3. S. 408.
- BARBOUR.—Anatomy of Labour, Edin., 1889; *Atlas of Anatomy of Labour*; Anatomy of Pregnancy and Labour, Roy. Coll. of Phys., Edin., Lab. Reports, vol. ii. 1890; The Third Stage of Labour, *Trans. Edin. Obst. Soc.*, vol. xiii. BARNES.—Sudden Death during Labour, *Br. Med. Jour.*, 1866, p. 345. BAYER.—Morphologie der Gebärmutter, etc., *Freund's Gynäk. Klinik*, Strassburg, 1885. BECK.—Nerves of Pregnant Uterus, *Lancet*, ii. 1856. BENKISER u. HOFMEIER.—Beiträge zur Anatomie des Schwangeren u. Kreissenden Uterus, Stuttgart, 1887. BISCHOFF.—Etudes sur la théorie de la menstruation, etc., *Arch. de Méd.*, 1854, p. 545. BOART DE LA FAILLE.—*Monat. f. Geburtskunde*, B. xxv. S. 318. BÖRNER.—Ueber den Puerperalen Uterus, Graz, 1875. BRAUNE.—Atlas of Topographical Anatomy. BROWN-SÉQUARD.—On Nervous Shock, *Holmes' System of Surgery*, vol. ii. p. 207. BUDIN.—*Obstétrique et Gynécologie Recherches cliniques et Experimentales*, Paris, 1886, p. 383. BÜRGER.—Ueber die Behandlung der iii. Geburtsperiode, München, 1889.
- CAZEAUX.—*Traité des accouchements*, 7^e éd., p. 56. CHAIGNOT.—Etude sur l'exploration et la sensibilité de l'ovaire et en particulier de la douleur ovarique chez la femme enceinte, Thèse de Paris, 1879. CHARCOT.—*Maladies du système nerveux*, 2nd ed., vol. i. p. 320. CHARPENTIER.—*Traité pratique des accouchements*, 1889. CHÉREAU.—*Memoire pour servir à l'étude des maladies des ovaires*, Paris, 1844, p. 137. CHURCHILL.—*Diseases of Women*, 1866. CLAUDIUS.—Ueber die Lage des Uterus, *Zeitsch. f. Rat. Medicin*, 1865, B. xxiii. S. 209, also *Med. Times and Gaz.*, i. 1865, p. 5. COHN.—Zur Physiologie u. Diätetik der Nachgeburtperiode, *Zeitsch. f. Geb. u. Gynäk.*, B. xii. H. 3. COURTY.—*Traité pratique des maladies de l'uterus*. CREDÉ.—Beiträge z. Bestimmung der normalen Lage der gesunden Gebärmutter, *Arch. f. Gynäk.*, 1870, B. i. S. 84; Ueber die Zweckmässigste Methode der Entfernung der Nachgeburt, *Mon. f. Geb.*, 1861, B. xvii. S. 274, and *Arch. f. Gynäk.*, 1881, B. xvii. S. 260; Die Behandlung der Nachgeburt, etc., *Arch. f. Gynäk.*, 1888, xxxii. 96-110. CROOM.—A Study of the Bladder during Parturition, Edin., 1884.
- DEPAUL.—*Clinique Obstet.*, Paris, 1872-76, p. 103. DEVALZ.—Du varicocèle ovarien, etc., Thèse, Paris, 1858. DOHRN.—*Deutsche Medicinische Wochenschr.*, 1880, No. 41. DUNCAN (MATTHEWS).—On the Mechanism of the Expulsion of the Placenta, *Ed. Med. Jour.*, April 1871.
- ELISCHER.—On the Nerves of the Ovary, *Lancet*, i. 1887, p. 290. ERICHSEN.—*Handbook of Surgery*, 2nd ed., London, 1882.
- FARRE.—The Uterus and its Appendages, *Suppl. Todd's Encycl. of Anat. and Phys.*, p. 645. FEHLING.—*Centralblatt für Gynäk.*, 1880, B. iv. S. 586. FÉRÉ.—La douleur dite ovarienne des Hystériques a pour siège l'ovaire, *Arch. de Neurol.*, 1882, vol. iii. p. 297. FISCHER.—Ueber den

- Shok, Sammlung Klin. Vortr. v. Volkmann, Leipzig, 1870, No. 10.
 FRANKENHÄUSER.—Die Nerven der Gebärmutter. FREUND.—Die Lage u. Entwicklung der Bechenorgane, Breslau, 1863. FRITSCH.—Krankheiten der Frauen, Berlin, 1889.
- GASKELL.—Visceral Nerves, *Lancet*, 1886, vol. i. p. 934. GROENINGEN und BARDELEBEN.—Ueber den Shock, Wiesbaden, 1885.
- HART (BERRY).—Topographical and Sectional Anatomy of the Female Pelvis, 1885; Note on the Mechanism of the Separation of the Placenta, etc., *Edin. Med. Journal*, July 1887; Improved Method of Managing the Third Stage of Labour, *Roy. Coll. of Phys. Lab. Rep.*, vol. ii. 1890; Mitral Stenosis and the Third Stage of Labour, *Trans. Obstet. Soc. Edin.*, vol. xiii. p. 9, and vol. xiv. p. 112. HASSE.—Beobachtungen über die Lage der Eingeweide in Weiblichen Beckeneingange, *Arch. f. Gyn.*, Bd. viii. S. 402.
- HEGAR and KALTENBACH.—Die operative Gynäkologie, Stuttgart, 1881.
- HELME.—Physiology of the Third Stage of Labour, *Trans. Obstet. Soc. Edin.*, vol. xiv. p. 14. HÉLIE.—Recherches sur la disposition des fibres musculaires de l'utérus développés par la grossesse, Paris, 1864. HERVIEUX.—Traité clinique et pratique des maladies puerperales, Paris, 1870, p. 371.
- HICKS.—Anatomy of Ovary, *Med. Times and Gaz.*, i. 1877. HIS.—Die Lage der Eierstöcke in der weiblichen Leiche, *Arch. f. Anat. und Phys.*, Leipzig, 1881, pp. 389-404. HOMBURGER.—Ueber die Beziehung der Stärke der Ligamenta Rotunda, etc., *Freund's Gynäkologische Klinik*, Bd. i. S. 677. HOSTEING.—Essai sur la syncope, Paris, 1877. HUNTER (JOHN).—Treatise on the Blood, Inflammation, and Gunshot Wounds, London, 1784.
- JASTREBOFF.—On the Normal and Pathological Anatomy of the Ganglion Cervicale Uteri, *Trans. Obstet. Soc. London*, 1882, xxiii. p. 125. JORDAN (FOURNEAUX).—Essay on Shock, *Brit. Med. Journal*, 1867, vol. i.
- JOULIN.—Traité d'accouchements, Paris, 1867, pp. 328 and 372.
- KÖLLIKER.—Ueber die Lage der Weiblichen inneren Geschlechtsorgane, Bonn, 1882. KRAUSE (C. F. T.).—Handbuch der Menschlichen Anatomie, Hannover, 1879-80-81. KRAUSE (W.).—Specielle Anatomie, 1879. KÜSTNER.—On the Axis of the Uterus, *Zt. für Geb. und Gynäk.*, Bd. xi. S. 2; Beitrag zur Anatomie der Cervix Uteri, *Arch. f. Gyn.*, Bd. xii. S. 383.
- LANDOIS and STIRLING.—Text-Book of Human Physiology (3rd edition).
- LEE.—Anatomy of Ovary, *Med. Times and Gaz.*, i. 1857; Atlas of Nerves of Uterus. LIEUTAND.—Anatomie historique et pratique, vol. ii. p. 165, note by Portal. LOTHROP.—Heart Failure in the Puerperium, *Trans. American Association of Obstetricians and Gynecologists*, 1888, vol. i. p. 280. LOUMAIGNE.—De la hernie de l'ovaire, Thèse 1869.
- M'CLINTOCK.—Dublin Med. Press, 1852. M'CORMACK.—Article "Shock," Quain's Dict. of Medicine. MARTIN (E.).—Die Physiologische Lage und Gestalt der schwangeren Gebärmutter bei der Lebenden, *Zt. für Geburt. und Franenk.*, B. i. 1876, S. 389. MORDRET.—Memoires Acad. Med., 1858. MUNDÉ.—Obstetric Palpation, New York, 1880. MURAT.—Dict. des Sciences Med., 1819, t. xxxix. p. 4.
- NEGRIER.—Sur les ovaires, Paris, 1840. NOTHNAGEL.—Handbuch der Krankheiten des Nervensystems, i. Ziemssen's Sammelwerk, xi. Bd., Leipzig, 1876.
- OLSHAUSEN.—Die Krankheiten der Ovarien, Stuttgart.
- PELIKAN.—Gerichtliche Med. Untersuchungen über den Skopzenthum in Russland, Giessen, 1876. PFANNKUCH.—Arch. f. Gynäkol., iii. B. 3. H.
- PIROGOFF.—Grundzüge der Allgemeinen Kriegschirurgie, Leipzig, 1864.
- POTT (PERCIVAL).—Surgical Works, vol. i. p. 492. PUECH.—Des Ovaires; de leurs Anomalies, *Mém. de l'Acad. de Montpellier*, 1870-71.
- RAINY.—On the Structure and Use of the Ligamenta Rotunda, *Phil. Trans. London*, 1850, part iii. RICHET.—Anatomie Médico-Chirurgicale, 4th ed., p. 581. RIOL.—"Délivrance par Expression," Paris, 1880. RITCHIE.—

- Ovarian Physiology and Pathology, 1865. ROBIN.—Mémoire sur le modification de la muqueuse utérine pendant et après la grossesse, Mém. de l'Acad. de Médecine, 1861 (at the end of this paper he speaks of the ovary). RÖMER.—On the Third Stage, Arch. f. Gynäk., Bd. xxviii. H. 2. ROUGET.—Article on "Ovary" in Dict. Encyclop. des Sciences Med., vol. xviii. Série 2^e. ROUTH (AMAND).—Rapid Dilatation of the Uterus, Practitioner, 1892. RUNGE.—Die Leitung der Nachgeburtsperiode, Berliner Klin. Wochenschrift, 1880, No. 44, and also in Cent. f. Gynäk., 1880, No. 26.
- SAPPEY.—Traité d'Anatomie Descriptive, Paris, 1881. SAVORY.—Article on "Shock," Holmes' System of Surgery, vol. i. p. 376. SCHATZ.—Ueber die Physiologie und Physiologische Behandlung der Nachgeburtsperiode, Allg. Wien. Med. Ztg., 1886, xxxi. 549. SCHAUTA.—On the Third Stage, Wiener Med. Blätter, 1886, Nos. 11-13. SCHROEDER und STRATZ.—Der Schwangere und Kreissende Uterus, Bonn, 1886. SCHÜLE.—Bemerk zur Behandlung d. Nachgeburtsperiode, Mon. f. Geburt., xxii. 1863, p. 15. SCHULTZE.—Ueber den Mechanismus der spontanen Ausscheidung der Nachgeburt und über den Credé'schen und den Dubliner Handgriff, Deutsche Med. Wochenschrift, 1880, Nos. 51, 52. SCHULTZE (B).—Zur Kenntniss von der Lage der Eingeweide im Weiblichen Becken, Arch. f. Gyn., Bd. ix. S. 262. SCHWARZ.—Article on "Uterus" in vol. xxxvii. Nouveau Dict. de Médecine. SIMMONS.—An Occasional Danger in the Use of Vaginal Injections, American Journal of Obstetrics, 1880, vol. xiii. p. 52. SINÉTY (DE).—De l'ovaire pendant la grossesse, Comptes Rendus de l'Acad. de Sciences, Aout 1877. SPIEGELBERG.—Text-Book of Midwifery, Sydenham Soc., 1889. STOLTZ.—Article "Grossesse" du Nouveau Dict. de Médecine, t. xvii. p. 14. SWAN (JOSEPH).—The Physiology of the Nerves of the Uterus and its Appendages, London, 1846. SYMINGTON.—On the Position of the Uterus and Ovaries in the Child, Edin. Med. Journal, July 1886.
- TARNIER et CHANTREUIL.—Traité d'accouchements, Paris, 1878, pp. 184-232. THIEDE.—Ueber das Verhältniss des Cervix Uteri, Zeitsch. f. Gynäk., Bd. iv. S. 210. TRAVERS.—Constitutional Irritation, 2 vols., 1835.
- VALENTIN.—Ueber die Entwicklung des Follikel in dem Eierstock der Säugethiere, Muller's Arch. für Anat. und Phys., 1838, p. 526. VELPEAU.—Traité d'accouchements, vol. i. p. 169. VINCENT.—Des Causes de la mort prompte après les grands traumatismes accidentels chirurgicaux, Paris, 1878.
- WALDEYER.—Eierstöcke und Ei, 1870. WATSON.—Discussion on the Intra-peritoneal Treatment of Abdominal Tumours, Brit. Med. Jour., 1881, p. 549. WEBSTER.—Female Pelvic Anatomy, Edin., 1892. WERNICH.—On Shock, Centr. f. Gynäk., viii. 1884, S. 170. WILLIAMS.—Physiological and Pathological Alteration in the Position of the Uterus, Lancet, ii. 1873, pp. 192 and 298. WINCKEL.—Die Pathologie und Therapie des Wochenbettes, 3rd ed., Berlin, 1878. WINTER.—Zwei Medianschnitte durch Gebärende, Berlin, 1889.

